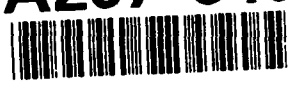

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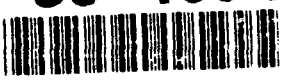
THE SAVINGS IN OPERATING COSTS AND BILLETS FROM CIVILIAN MANNING OF NAVY UNDERWAY REPLENISHMENT SHIPS

Daniel B. Levine
Stanley A. Horowitz, *Project Leader*

March 1993



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INSTITUTE FOR DEFENSE ANALYSES
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This paper shows that the Navy could save considerable cost and billets by operating more of its underway replenishment ships with civilian mariners under the Military Sealift Command (MSC). By transferring to MSC all of the replenishment ships still under Navy operation, the Navy would save between 10,000 and 12,000 billets and between $280 million and $380 million in annual operating cost. The variation is due to two uncertainties not estimated by the study: the sea-shore rotation statistics of the shipboard ratings (the Navy's target of no more than 50 percent of the time at sea is often not met), and the essentiality of the tasks the shipboard ratings perform while ashore. Using small civilian crews sometimes raises Navy concerns about issues such as ship safety and personnel availability, productivity, and reliability. However, the recent experience of replenishment ships operated by the Navy, MSC, and the British Royal Fleet Auxiliary provides little evidence to support such fears.

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INSTITUTE FOR DEFENSE ANALYSES

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PREFACE

This paper was prepared by the Institute for Defense Analyses (IDA) for the Office of the Assistant Secretary of Defense (Force Management and Personnel) [OASD(FM&P)], under contract MDA 903 89 C 0003, Task Order T-L7-798, issued 15 March 1990, and amendments. The objective of this portion of the task was to estimate the savings in cost and U.S. Navy billets that the Navy could obtain by operating more of its underway replenishment ships with civilian manning, under the Military Sealift Command.

This work was reviewed within IDA by Alfred I. Kaufman, Bruce N. Angier, and Karen W. Tyson.

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FIGURE

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A. INTRODUCTION

This paper presents estimates of how much money and Navy billets the U.S. Navy could save by transferring more of its replenishment ships to the Military Sealift Command (MSC) for operation by civilian mariners.

The analysis does not consider any of the other differences, apart from cost and billets, between Navy and MSC operation. Navy replenishment ships serve as platforms to train naval officers and enlisted people, they maintain a high order of discipline that ensures the crew will function under fire, they are trained to fight the ship (MSC ships lack self-defense weapons), they are authorized to carry nuclear ordnance for the battle group, and they act as integral parts of a coordinated battle group.

Navy underway replenishment ships bring POL (petroleum, oil, and lubricants), ordnance, and general cargo from port to combatants at sea. The products are delivered to the combatants while underway, using hoses, various kinds of solid-cargo rigs, and helicopters. POL is carried on oilers (designated as AOs), ordnance on ammunition ships (AEs), and general cargo—food and other housekeeping goods—on store ships (AFs and AFSs). Only one AF is left in the active fleet, having been replaced by the AFSs, which store items in many separate bins so that loads can be tailored to the combatants' needs at the time of transfer. Replenishment oilers (AORs) and fast combat support ships (AOEs) are multi-product ships that carry large amounts of both POL and ordnance.

The AOs and AEs are usually operated in the shuttle role, bringing POL and ordnance from port to sea for transfer either to the combatants directly, or to the AOR and AOE station ships, which make the final transfer to the combatants. (Station ships stay with the combatants, unlike the shuttle ships, which return to port on a regular cycle for more cargo.) The AFs/AFSs shuttle cargo to the Fleet and make the transfer themselves.

MSC is the Department of Defense's single manager for sealift. In addition to performing its point-to-point transportation mission, MSC has been operating some of the Navy's shuttle replenishment ships (but not station ships), using civil-service mariners, since 1971. The civilian crews are augmented by relatively small Navy military departments for special functions such as secure communications, managing the complicated supply service on the AFSs, and handling ordnance on the AEs.

Greater use of civilian operation of replenishment ships currently manned by all-Navy crews would help the Navy, in this period of military downsizing, to achieve reductions in the number of Navy billets (job slots). AOs that typically operate with 200-

person Navy crews need only a 20-person Navy military department under MSC operation; AOEs save almost 400 Navy billets. We will therefore be estimating the reduction in sea-going Navy billets from transferring more of the replenishment ships to MSC.

In addition to reducing Navy billets, civilian operation saves on cost by reducing total crew size. MSC crews are roughly half the size of Navy crews. The reduction in total crew size is illustrated by Figure 1. Although the Navy oiler AO-177 and MSC oiler TAO-187 (MSC ships are denoted by "T") are similar in delivery capability (size of cargo, number of replenishment rigs, etc.), the crew on the TAO (including a 23-person military communications department) is about half the size of the Navy crew on the AO (112 versus 220). The MSC ship's crew (including the military department) averages 24 years in length of service, compared to only about 5 years for the Navy ship. (The crew sizes are based on manpower authorizations for both ships, Navy and MSC.)

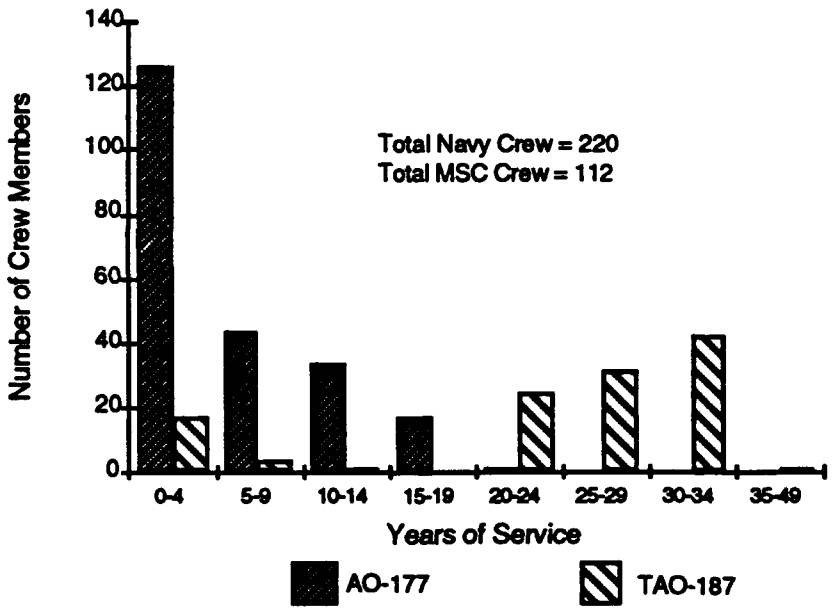

Figure 1. Navy Versus Civilian Experience and Crew Size

Although, MSC ships have smaller crews, merchant pay rates are higher than Navy rates—but only by a few percent. The net effect is thus a substantial lowering of manning costs. The savings are $4 million to $15 million annually per ship (see Table 3, shown later), depending on the type of ship. Since other operating costs such as fuel and maintenance are about the same for Navy and civilian operation—they depend on the ship's design and operating tempo—there is a saving in total O&S costs. Transferring ships from Navy to MSC operation requires some one-time habitability modifications, such as

constructing more comfortable quarters. These modifications cost less than $1 million per ship, small compared to the $4 million to $15 million savings in manpower cost that are realized *annually* over the life of the ship.

The next section of the paper summarizes the findings of the analysis. It shows the reduction in Navy billets and O&S costs for various manning options. This is followed by a detailed description of the options and how the billet and cost figures were derived. The paper concludes with a brief discussion of other issues concerning civilian operation of Navy ships: ship safety, and personnel availability, productivity, and reliability.

Our analysis benefited from recent analyses of civilian manning by the Center for Naval Analyses (CNA) (Reference [1 and 2]), and from data supplied by MSC.

B. SUMMARY OF FINDINGS

Table 1 presents the manning options that were analyzed. Each option is characterized by the number of replenishment ships operated by the Navy and MSC, as well as the number in a reserve status. For our purposes, "reserve" means the ship is tied up with no crew in peacetime, but receives enough periodic maintenance to be activated in a matter of weeks. An example is the Ready Reserve Force (RRF), a component of the National Defense Reserve Fleet, whose ships have targeted activation times of 5, 10, and 20 days. Activated RRF ships are operated by a private owner under contract to the Maritime Administration. The owner recruits a union crew, and the ship is placed under the operational control of the Military Sealift Command.

The first option corresponds to the current Fleet. The next two options are pure manning alternatives: the number of active and reserve ships are held constant, but more of the active ships are operated by MSC. Option 2 transfers all the shuttle ships to MSC, and Option 3 transfers all the station ships as well. Options 4 and 5 combine manning options with the reductions in active force levels recommended in Reference [1]. Six AOs and three AFs/AFSs are moved to the reserves. This would reduce the number of active replenishment ships to levels that are sufficient, according to analyses in Reference [1], to provide the average replenishment service that combatants received during 1984-88.

Table 1 also summarizes the number of Navy sea-going billets and yearly manning and maintenance costs for the various alternatives. Note that the focus in this paper is on *Navy* billets and *total* (Navy plus MSC) costs. The billets and manning costs were calculated from detailed shipboard manning levels and wage rates for Navy and MSC ships. The maintenance costs were obtained from the VAMOSC-Ship data base (VAMOSC

stands for Visibility and Management of Operations and Support Cost). Maintenance costs are included in the study because they differ between active and reserve ships (but not significantly between Navy and MSC operation of active ships).

Table 1. Sea-Going Billets and Costs of Civilian Manning Options for Replenishment Ships

	Current Active Forces			Reduced Active Forces	
	Option 1: Current Disposition	Option 2: Civilian Manning of All Shuttle Ships	Option 3: Civilian Manning of All Ships	Option 4: Civilian Manning of All Shuttle Ships	Option 5: Civilian Manning of All Ships
AO					
Navy	5				
MSC	18	23	23	17	17
Reserves	11	11	11	17	17
AE					
Navy	7				
MSC	1	8	8	8	8
Reserves	5	5	5	5	5
AF/AFS					
Navy	7				
MSC	4	11	11	8	8
Reserves				3	3
AOR					
Navy	4	4			
MSC			4	4	4
Reserves	3	3	3	3	3
AOE					
Navy	6	6		6	
MSC			6		6
Reserves					
Numbers of Sea-Going Billets					
Navy	11,865	6,366	1,744	4,549	1,459
Mariners	2,266	4,524	5,938	4,045	4,999
Costs (millions of FY93 dollars)					
Manning	672	527	394	421	334
Maintenance	410	410	410	387	387
Total	1,082	937	804	808	721

The first two columns of Table 2 (Minimum Savings) portray the billet and cost information from Table 1 in terms of savings relative to Option 1. These savings in sea-going billets and cost constitute a lower limit on the total savings for these options. The last

two columns of Table 2 exhibit an upper limit, obtained by assuming that the Navy also eliminates some shore billets for sea-going ratings. In general, the number of shore billets that could be eliminated depends on two factors. One is the sea-shore rotation practices of the shipboard ratings. The Navy's stated policy is for personnel to spend no more than 50 percent of their total time at sea, but the actual number is often higher, sometimes 75 percent. A second factor is the essentiality of the tasks the shipboard ratings perform while they are stationed ashore, between deployments. Suppose, for example, that shipboard ratings spend 50 percent of their time at sea, on average. That would *not* imply that the Navy could automatically eliminate shore billets on a one-for-one basis when sea-going billets are eliminated. Shore personnel do useful work between deployments, and the number of shore billets that could be eliminated would depend on the essentiality of these tasks.

Table 2. Navy Billet and Cost Savings of Civilian Manning Options for Replenishment Ships

	Minimum Savings		Maximum Savings	
	Navy Billets	Costs (millions of FY93 dollars)	Navy Billets	Costs (millions of FY93 dollars)
Transfer Navy-operated Shuttle Ships to MSC (Option 1 less Option 2)	5,500	$140	6,600	$190
Transfer Navy-operated Shuttle and Station Ships to MSC (Option 1 less Option 3)	10,100	$280	12,100	$380
Transfer Navy-operated Shuttle and Station Ships to MSC, and transfer 6 oilers and 3 AF/AFSs from MSC to the reserves (Option 1 less Option 5)	10,400	$360	12,500	$480

The maximum savings in Table 2 were calculated using the sea-shore rotation experience the Navy is currently experiencing in the Fleet as a whole. (Data by individual ship type were not available.) These figures are 100 percent time-at-sea for E3-4s, 55 percent for E5s and up, 60 percent for O1-4s and WO1-4s, and 40 percent for O5-6s. These percentages were weighted by the distribution of ratings on the replenishment ships to obtain an average time-at-sea percentage for each type of ship (AO, AE, AF/AFS, AOR, and AOE). Taking the reciprocal of these time-at-sea percentages yielded the billet ratios (ratio of total billets to sea-going billets). The ratios average 1.20 over the various ship types (the range was 1.16–1.25), and this factor was multiplied by the savings in sea-going billets in Table 2 to estimate the total savings in Navy billets.

The savings in cost were calculated by (1) taking these savings in total Navy billets, (2) adding in the savings in total MSC billets obtained by multiplying the savings in sea-going mariners by 1.25 (MSC mariners typically spend 80 percent of their time at sea), and (3) multiplying the result by $50,000, the approximate cost of Navy and MSC replenishment ship personnel derived in Table 4 (shown later). The cost savings for the last alternative also includes the $23 million reduction in maintenance costs between Options 1 and 5.

Thus, the analysis shows that the Navy could save at least 5,500 billets and $140 million in annual operating costs by transferring the remaining Navy-operated shuttle replenishment ships to MSC for civilian operation. These savings would roughly double if the station replenishment ships were transferred as well. Additional savings in Navy billets (20 percent) and cost (35 percent) could be obtained, but at unknown *operational* cost, by eliminating the shore billets corresponding to the sea-going billets. The Navy could realize even more savings by reducing active forces to the levels that are sufficient according to analyses in Reference [1], to provide the average replenishment service that combatants received during 1984-88. We have not, however, made an independent assessment of how much replenishment support the combatants need.

To see if MSC crews could be further reduced in size, we compared them with the crews of the Royal Fleet Auxiliary (RFA), the British version of MSC. The results were negative; the RFA crews were no smaller than those of MSC. An RFA tanker of the Olwen class, for example, which has a 36,000-ton displacement, has a 148-person crew, including a Royal Navy contingent of 40. The MSC's new oiler, the TAO-187, which has about the same displacement (37,000 tons) has only a 110-person crew, including a 21-person Navy military department. The same relationship holds true for ordnance ships. The RFA's *Fort Grange*, which has a 23,400-ton displacement and carries 3,500 tons of ordnance, is operated with a crew of 243, including 63 Royal Navy. The MSC's TAE-26, which displaces 17,900 tons and carries about 4,000 tons of ordnance, has a crew of only 164, including 44 Navy.

There are two caveats for the analysis. First, the Navy would not have to transfer ships to MSC to save manning cost. The Navy could also use small, highly-trained crews, just as MSC does. This, of course, would require changes in the Navy's manning policy and the mission of the underway replenishment ships.

The second caveat regards the question of risk. Although our data show that small, highly-trained crews have sailed ships safely in the past, this is not an absolute guarantee for the future. The Navy might choose to forgo the savings we have estimated, and

maintain the current crew sizes as a safety precaution in handling accidents and wartime battle damage.

Civilian manning sometimes raises the specter of problems such as ship safety and personnel availability, productivity, and reliability. Historical data, however, indicates that civilian manning has not led to serious problems. MSC has never operated the AOR and AOE station ships, however, and if there are concerns, the concept could be tested at sea before implementation.

C. DERIVATION OF RESULTS

1. Description of Options

Table 3 shows additional detail for the options shown in Table 1. The information in this section was obtained from various editions of *Jane's All the World's Fighting Ships*. Except for the AOEs, which have top speeds of 26 knots, all the ships have speeds around 20 knots. The oilers carry 150,000–180,000 barrels of fuel. The AO-105s and AO-143s were built in the mid-1940s and mid-1950s, and are now in the reserves. The AO-177s were built in the early 1980s, and the AO-187s are at the end of a large, 18-ship procurement program. The last two are planned for completion within the next 2–3 years. (The ships in Table 3 are referred to by design class; the "T" is omitted from the MSC ships for convenience.)

The AEs carry approximately 4,000 tons of ordnance. The AE-21/23s are old ships now in the reserves. The AE-26s were commissioned in 1968–72, and are thus 21–25 years old. Given that many Navy ships have been kept in active service for 35 years and more, the AE-26s still have some years of life left. The Navy transferred the lead ship of the class (hull number AE-26) to MSC as a trial case in 1980. The Navy has not transferred the seven other ships of the AE-26 class to MSC.

The TAF-58 is an old store ship that was built in 1955 but is still in service. (Stores are dry, chilled, and refrigerated food, and general housekeeping items.) The seven AFS-1 store ships were commissioned in 1963–70. They carry about 4,000 tons of stores in bins that permit the ship to selectively break out the specific items ordered by the combatants. They are now operated by the Navy.

The TAFS-8 ships are roughly similar to the AFS-1s in speed, cargo capacity, and transfer capability. They were originally built for the Royal Fleet Auxiliary, which operated them for a time and then sold three of them to the U.S. Navy (1981–83). They are now operated by MSC.

Table 3. Manning Options for Replenishment Ships by Class

	Current Active Forces									Reduced Active Forces					
	Option 1: Current Disposition			Option 2. Civilian Manning of All Shuttle Ships			Option 3: Civilian Manning of All Ships			Option 4: Civilian Manning of All Shuttle Ships			Option 5: Civilian Manning of All Ships		
	Navy	Civilian	Reserve	Navy	Civilian	Reserve	Navy	Civilian	Reserve	Navy	Civilian	Reserve	Navy	Civilian	Reserve
Oilers															
AO-105			5			5			5			5			5
AO-143			6			6			6			6			6
AO-177	5				5			5				5			5
AO-187		18			18			18			17	1		17	1
Total	5	18	11		23	11		23	11		17	17		17	17
Ammunition Ships															
AE-21/23			5			5			5			5			5
AE-26	7	1			8			8			8			8	
Total	7	1	5		8	5		8	5		8	5		8	5
Store Ships															
AF-58		1			1			1				1			1
AFS-1	7				7			7			5	2		5	2
AFS-8		3			3			3			3			3	
Total	7	4			11			11			8	3		8	3
Multi-Product Ships															
AOR-1	4		3	4		3		4	3		4	3		4	3
AOE-1	4			4				4			4			4	
AOE-6	2			2				2			2			2	
Total	10		3	10		3		10	3		10	3		10	3

The AOR-1s are multi-product ships that carry 160,000 barrels of POL, 600 tons of ordnance, and 300 tons of stores. They were commissioned in 1969–76. Four are now operated by the Navy, and three are in the reserves. The AOE-1s have a 26-knot speed that enables them to more easily keep up with a battle group during high-speed transit. They were commissioned in 1964–70, and carry 177,000 barrels of POL, 2,150 tons of ordnance, and 750 tons of stores. The AOE-6s have about the same speed (25 knots) and carry 156,000 barrels of fuel, 1,800 tons of ordnance, and 650 tons of stores. Four of these ships have been placed under contract (AOE-6, 7, 8 and 10) and are scheduled for delivery in FY 1993–98.

The alternative force mixes shown in Table 3 are variations in manning and active force levels. Each option has the same total number of ships in the Navy, MSC, and the reserves. Options 2 and 3 hold the active forces constant at today's levels, shown in Option 1. Option 2 transfers all the shuttle ships to MSC, and Option 3 transfers *all* the ships to MSC, including the AOR and AOE station ships.

Options 4 and 5 transfer the shuttle and station ships to MSC just as options 2 and 3 do. In addition, they also reduce active force levels by taking advantage of the fact that MSC ships have higher utilization rates than Navy ships. In general, replenishment ships spend time out of productive service for a variety of reasons: maintenance, training, POL limitations, personnel time-at-sea constraints, and scheduling problems in serving the combatants. MSC ships are subject to fewer of these constraints than are Navy ships. Their crews are more experienced and therefore require less training in ship handling. Moreover, MSC ships do not suffer from the POL funding constraints that are sometimes imposed on Navy ships.

A recent CNA study, Reference [1], estimates the number of active civilian-operated shuttle ships that would be able to support combatants, by dividing the annual days of shuttle service required by the Fleet by the productivity (days of service) per MSC shuttle ship. (The AOR and AOE station ships were held constant at 10, less than one per carrier battle group.) The CNA study estimated the productivity of MSC replenishment ships by noting that these ships have been averaging only about 80 days in intermediate and depot-level maintenance annually (1984–88 data), and concluding that these ships could operate productively in the Fleet for the remaining 285 days per year. This is much higher than the 164–236 days of service provided by the Navy-operated AOs, AEs, and AFSs in the Atlantic and Pacific Fleets during the same time period.

The CNA study estimated the average number of days of service required by the Fleet using 1984–88 data, and dividing these figures by the productivity of the MSC ships.

This calculation leads to active force levels of 17 AOs, 10 AEs, and 8 AFSs. (The calculations in [1] optimistically assume that an increase in replenishment ship productivity translates into a proportional reduction in force levels. This assumption ignores the existence of "fixed requirements": If 10 shuttle oilers can service 10 widely-dispersed carrier battle groups and the productive time per oiler is doubled, 10 oilers would still be needed.) We chose the AO and AFS figures for our Options 4 and 5 in Tables 1 and 2, and reduced the number of AEs to 8, the number in today's active force. The Navy could obtain the 10 active AEs required by the CNA calculations by re-activating 2 of the AE-21/23 class. (Using the *peak* days of required service during that time period—the service during the year of highest demand—yielded force levels of 19 AOs, 10 AEs, and 10 AFSs.) The ships taken from the active force are put into the reserves, thus holding total wartime force levels constant.

2. Sea-Going Billets and Manning Costs

The numbers of sea-going billets and costs in Table 1 were derived by multiplying the force levels in that table by the billets and costs for the lead ship of each type: the AO-177, AE-26, AFS-1, AOR-1, and AOE-1. (The figures for total billets and costs were calculated from the sea-going figures, as described in Section B, Summary of Findings.) Table 4 shows these unit figures in detail.

The manning levels for the Navy ships were obtained from the VAMOSC-Ships database. They are the levels in actual use, considerably lower than the planned levels for peacetime (Manpower Authorizations, or MPA), and much lower than the planned levels for wartime (contained in the Ship Manpower Documents). The manning levels for the MSC ships, mariners plus Navy departments, were recently obtained from MSC. They are authorized levels, which are slightly higher than actual figures. By comparing actual manning levels for Navy ships with higher-than-actual levels for MSC ships, we have underestimated the savings from civilian manning.

The average wage rate for each Navy ship was derived by applying billet costs from Reference [3] to the number of personnel in each paygrade, and dividing by the total number of personnel. We used the Manpower Authorizations for these calculations, since the VAMOSC-Ships database does not report manning breakdowns by paygrade. The error should be small, since the average wage rate depends on the *distribution* of personnel by paygrade, not the total number of people.

Table 4. Sea-Going Billets and Manning Costs of Navy and Civilian Manning

	AO		AE		AF/AFS		AOR		AOE	
	Navy	MSC	Navy	MSC	Navy	MSC	Navy	MSC	Navy	MSC
Manning										
Officers	15	1	20	2	27	5	22	1	26	2
Enlisted	188	22	322	38	377	44	390	28	529	38
Total Navy	203	23	342	40	404	49	412	29	555	40
Mariners		89		124		135		115		159
Total	203	112	342	164	404	184	412	172	555	237
Average Annual Cost per Person (thousands of FY93 dollars)										
Officers	92.0	101.8	89.9	96.9	89.7	107.7	91.3	96.9	91.8	96.9
Enlisted	46.7	47.7	44.6	49.4	45.0	49.3	44.5	49.4	43.8	49.4
Total Navy	49.4	50.1	46.6	51.8	47.7	55.3	46.8	51.8	45.8	51.8
Mariners		50.4		55.0		45.2		55.0		55.0
Total	49.4	50.4	46.6	54.2	47.7	47.9	46.8	54.2	45.8	54.2
Annual Manning Cost (milllions of FY93 dollars)										
Officers	1.4	0.1	1.8	0.2	2.4	0.5	2.0	0.1	2.4	0.2
Enlisted	8.8	1.1	14.4	1.9	16.9	2.2	17.4	1.4	23.2	1.9
Total Navy	10.0	1.2	15.9	2.1	19.3	2.7	19.3	1.5	25.4	2.1
Mariners		4.5		6.8		6.1		6.3		8.7
Total	10.0	5.6	15.9	8.9	19.3	8.8	19.3	7.8	25.4	10.8

The billet costs, shown in Table 5, were obtained from Reference [3]. These costs consist of (1) base pay and fringe benefits, (2) amortized costs of prior training and future retirement, and (3) an allowance for non-productive time due to sick leave, holidays, etc. (Reference [3] uses the term "Standard Manyear Cost" for this sum, and "Billet Cost" for the sum less the allowance for non-productive time.) We used the "All Navy" figures for enlisted personnel and the "Surface Warfare" figures for officers (both escalated to FY 1993 dollars). The "All Navy" figures for officers are much higher than those for "Surface Warfare" because of the high costs of specialties such as pilots. We used billet costs rather than base pay for the Navy crews because they are more comparable to the merchant pay rates, which include training and retirement costs (discussed below.)

The manning costs in Table 4 for the civilian-manned ships were obtained from MSC, and consist of the total wages for the ship; the average rates are shown for comparison. The costs for the AORs, and AOEs are estimates, since these types of ships have never been operated by MSC. The mariner costs consist of base pay, fringe benefits,

overtime, and pipeline (unproductive time). The costs of training and retirement are reflected in base pay and fringes. The costs for the military departments were calculated by applying Navy billet costs to the specific Navy grade levels on these ships.

Table 5. Navy Billet Costs

Paygrade	Annual Cost (FY 1993 dollars)
Officers	
O6	154,895
O5	130,190
O4	117,191
O3	101,791
O2	76,579
O1	59,900
WO4	154,895
WO3	102,809
WO2	88,832
WO1	74,276
Enlisted	
E9	86,474
E8	73,907
E7	65,433
E6	57,569
E5	50,202
E4	44,060
E3	36,198

The average manning costs for all the Navy ships are virtually identical at about $90,000 for officers and $45,000 for enlisted personnel, or about $47,300 for the total crew, averaged over the five ship types. The average crew cost for the MSC ships is about $52,200, 10 percent higher than the average for the Navy ships. The mariners are more costly than Navy crew on average, as are the officers and enlisted personnel of the military departments that provide specialized services.

3. Maintenance Costs

The Navy maintenance costs in Table 1 were obtained from annual costs per ship shown in Table 6, which were obtained, in turn, from the VAMOSC-Ships database as of August 10, 1992. They were obtained by summing the costs for direct intermediate maintenance and direct depot maintenance (VAMOSC elements 2.0 and 3.0). The FY 1992 figures were escalated to FY 1993 using the SCN deflator. The costs for the MSC ships were set equal to those for the Navy ships. The reserve costs were obtained from Reference

[1]. The reserve costs for the AO, AOR, and AOE include a yearly share of the $2.6 million required to maintain the epoxy coating on the POL tanks every 5 years.

Table 6. Annual Maintenance Costs

	Cost (millions of FY93 dollars)				
	AO	AE	AF/AFS	AOR	AOE
Navy	$2.58	$8.57	$9.32	$12.87	$13.87
MSC	$2.58	$8.57	$9.32	$12.87	$13.87
Reserves					
General maintenance	$1.55	$1.55	$1.55	$1.55	$1.55
Breakout	$0.41	$0.41	$0.41	$0.41	$0.41
Tank maintenance	$0.52			$0.52	$0.52
Total	$2.48	$1.96	$1.96	$2.48	$2.48

D. OTHER CIVILIAN MANNING ISSUES

We have shown that the Navy could save on billets and cost by transferring all its shuttle and station ships to MSC. The Navy has historically had reservations about MSC operation because of the smaller crew sizes, as well as possible problems with civilian manning per se. This section discusses four main issues: ship safety, personnel availability, personnel productivity, and personnel reliability. Options 4 and 5, which make greater use of the reserves, raise the maintenance-related problem of activating reserve ships in emergencies. This is a different issue than civilian manning, however, and is not discussed here.

1. Ship Safety

Although MSC mariners can carry out basic ship functions with half the number of people because of their greater training and experience, smaller crews may lack enough extra hands to handle fires and other emergencies that might arise in peacetime operations or from wartime battle damage. This has been one of the Navy's objections to transferring the rest of the AE-26s (other than the lead ship) to MSC.

Since safety is obviously an important issue, we analyzed some historical data from the Navy Safety Center in Norfolk, Virginia, to see if the MSC ships are, in fact, less safe. The results, summarized in Table 7, suggest that at least during the past 10 years, the MSC replenishment ships have had an attractive safety record by comparison with the Navy replenishment ships. If we look first at the totals over all types of incidents, the average number of incidents per ship per year is actually less for MSC than the Navy. The MSC

incidents cost more to repair, on average, but the total cost of all MSC incidents is less by 28 percent ($80.7 vs. $112.1 thousand per ship per year).

Table 7. Number and Cost of Accidents, MSC Versus Navy Operation, 1982–92

	Incidents per Ship per Year		Average Cost per Incident (thousands of FY93 dollars)		Total Cost per Ship per Year (thousands of FY93 dollars)	
	MSC	Navy	MSC	Navy	MSC	Navy
Fire	0.11	0.44	58.2	66.9	6.5	29.1
Weapons related	0.0	0.01	0.0	2.7	0.0	.038
Explosion, non-ordnance	0.04	0.03	241.3	199.5	8.6	6.1
Flooding	0.06	0.22	12.1	15.7	0.7	3.5
Collision	0.16	0.08	183.3	258.1	28.9	21.6
Other	0.20	0.44	171.9	95.0	34.0	42.2
Total	0.56	1.23	143.3	91.2	80.7	112.1

Source: U.S. Navy Safety Center, Norfolk, Virginia.

MSC also had a good record regarding those mishaps that are potentially most serious. MSC had fewer fire incidents per ship per year, and, along with the Navy, a small number of weapons-related and non-ordnance explosions. Collisions, however, were more numerous. As a final summary statistic, MSC had only two incidents above $2 million in repair cost; the Navy ships had three.

Because casualties on ordnance-carrying ships can be especially dangerous, we compared the experience of the MSC AE-26 with that of the Navy ordnance-carrying ships (AEs, AORs, and AOEs). (The following figures are not shown; the figures in Table 7 are for *all* ships, not just the ordnance carriers.) The AE-26 had no fire or weapons-related incidents during the period, whereas the Navy ordnance ships had 0.22 fires per ship per year. The AE-26 did, however, have a higher rate of non-ordnance explosions, 0.09 versus 0.02 incidents per ship per year.

For independent information on civilian manning, we looked at the British experience with the Royal Fleet Auxiliary. The RFA, the British version of MSC, uses civilian manning for normal ship operations, and Royal Navy seamen for communications and ordnance and stores management.

Unlike the U.S. Navy's practice, the British Navy uses the RFA for *all* its replenishment needs, including station ships. Despite the fact that station ships have a more hazardous mission than shuttle ships (they conduct more frequent replenishment-at-sea operations, with combatants frequently alongside both port and starboard sides), the British

have had even better experience with civilian manning than the United States. The RFA has had only one eighth as many accidents per year as MSC (Table 8). (The RFA replenishment fleet is smaller than the MSC replenishment fleet, 17 versus 26 ships at present, but this hardly explains the disparity in accident rates per year.) According to the British data, only three of the incidents in the 42-year period involved a total or near-total loss of the ship. (As we will describe later, two RFA ships suffered heavy loss or damage during the Falkland Islands War; these were casualties of combat, however, not the result of poor safety.)

Table 8. Royal Fleet Auxiliary Versus MSC Safety Record

	Number of incidents					Number of years	Number per year
	Grounding	Collision	Fire	Flooding	Total		
Major incidents,							
RFA, 1946–88	18	14	6	1	39	42	0.9
MSC, 1982–92	10	31	22	12	75	10	7.5

2. Personnel Availability

Although transferring more ships to MSC would reduce the Navy's manning cost and billet requirements, there is the question of whether there would be an adequate supply of *civilian mariners* to man the ships. In the long run, the market (including a possible increase in wage rates) may take care of the problem. Even in the short run, data in Reference [2] suggest that there would not be a major problem. The current billet ratio for mariners in the private sector (*not* MSC personnel) is approximately two mariners per sea billet (an at-sea time of 50 percent). Thus, only 21,000 of the current stock of 26,000 private sector mariners are needed to fill the 10,500 sea billets for licensed and unlicensed mariners on U.S.-flag commercial ships (data from Reference [2]). That leaves 5,000 mariners to spare. If they were attracted into MSC and served at the *MSC* billet ratio of 1.25, they could fill 4,000 sea billets, more than the 3,672 additional civilian sea billets required by Option 3 (5,938 – 2,266, from Table 1).

We have not estimated how many of these 5,000 former mariners would sign up with MSC at various wage rates. Many of these people might be presently employed at non-maritime jobs, but at least some of them might be attracted back to their former careers if jobs opened up. Moreover, the unemployment picture is still dim. Finally, the supply of potential MSC sailors will rise as Navy shipboard ratings are forced out of the service by the current manpower reductions.

Manning the reserve ships in an emergency is a different problem. Options 4 and 5 have the same number of ships as Options 1–3, but more of them are in reserves. The Navy would thus need to find more extra crew in a matter of weeks, rather than in a year or two implicit in the discussion above. The material in the next section, dealing with the activation of the Ready Reserve Force for Desert Shield, indicates that this might not be a major problem.

3. Personnel Productivity

According to data from Desert Storm that have been collected and analyzed by CNA (Reference [2]), civilian mariners performed acceptably in that conflict. During the period of data collection, the MSC TAE-26 averaged 84 tons per transfer in supplying ordnance to the Navy combatants in the area. This was less than the *average* of 124 tons delivered by the Navy AE-26 that had similar duty, but the MSC ship had the two largest single transfers. (The study found that *all* the replenishment ships had problems coordinating with their customers because of communications problems, although things improved as the war progressed and people learned how to cope.) The MSC store ships, TAFS-8 and TAFS-9, transferred 23 percent more pallets per hour than the Navy ships, the AFS-2 and AFS-6.

The CNA study mentions that the Navy is concerned with the endurance of small civilian crews. However, in the detailed AE simulations carried out by CNA and reported in Reference [2], there was only one replenishment scenario in which the MSC crew took significantly longer than the Navy crew, and that was an especially stringent case in which the AE used connected and vertical replenishment to *simultaneously* transfer ordnance to a carrier, two destroyers, and two cruisers. Even here, the margin was not substantial; the MSC ship took only 3 to 5 hours more on a replenishment taking two 18-hour days.

4. Personnel Reliability

The concern here is that civilian mariners will not sail into dangerous waters during future conflicts. History fails to indicate a problem. Civilian-crewed ships have served in many past conflicts, including the high-casualty Murmansk run against the German submarine threat in World War II. Private and civil-service crews sailed into Vietnamese waters. (The feared threat failed to materialize.) Ships of the civilian-manned Royal Fleet Auxiliary continued to deliver cargo to the Falkland Islands theater in 1982, even after air attack had led to the sinking of the *Sir Galahad* with the loss of five lives, and extensive damage to the *Sir Tristram* with the loss of two lives.

The activation of the Ready Reserve Force (RRF) ships for the recent Persian Gulf War provides additional support for civilian manning. Of the 96 ships in the RRF, 78 were activated, the number requested by the Navy. Some of the activations took longer than the planned targets of 5, 10, and 20 days, but the delays were due solely to maintenance problems. None of the ships was delayed in sailing because of lack of trained crew.

The manning record was not perfect, however. The crew of *Cape Alexander* had to be replaced when the original crew walked off the ship because the owner had not paid them. The master of the *Cape Archway* lacked the appropriate license and had to be replaced, and the *Northern Light* had some crew members who were fired by the master.

According to the MSC, there have been no serious manning problems such as strikes with MSC civilian-manned ships since 1951, when MSC was created and began operating ships for the sealift and other support missions. (Operating ships for the replenishment mission did not start until 1971.) No doubt, a contributing factor to MSC's good record is the illegality of strikes by civil-service employees.

E. SUMMARY

Our analysis found that the Navy could save over 10,000 Navy billets and at least $280 million in annual operating cost by transferring all the replenishment ships still operated by the Navy to the Military Sealift Command.

Some have suggested that civilian manning would compromise ship safety and that civilian crews would be less available, productive, and reliable than Navy crews. History provides no evidence of this. Civilian crews have carried out support missions in combat situations since World War II without major incident. Operations have never been suspended because of labor problems or lack of discipline. Since 1971, MSC's smaller, more experienced crews have conducted hazardous replenishment at sea in peacetime and contingency situations, including the recent Persian Gulf War. There have been no difficulties using civilian mariners in the past.

The analysis has two qualifications. First, the Navy need not transfer its replenishment ships to MSC to realize the cost savings of using small, experienced crews. Small, more experienced *Navy* crews would do as well. Second, although small, civilian crews have conducted replenishment operations safely and efficiently in the past, history is not an absolute guarantee for the future. The Navy could continue to operate its replenishment ships as it now does, in order to retain the benefits of extra crew members for emergency situations.

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